HERMETICALLY SEALED ELECTRICAL SWITCH ASSEMBLY

FIELD OF THE INVENTION

The present invention relates generally to electrical switches, and more particularly to a hermetically sealed electrical switch assembly having a low manufacture cost.

BACKGROUND OF THE INVENTION

In conventional electrical switches, especially those used in power circuits, the contacts are exposed to air. Corrosion of the components of these kinds of switches is liable to occur after the switches are used for a period of time, resulting in a poor sensitivity of the switches. In addition, such switches are not suitable for use in dust, moist, easily explosive or combustible environments. Several different types of switches for preventing explosions have been developed, such as oil switches, safety switches, and so forth. However, due to the complex structures of these

switches, they are unpractical from a manufacturing standpoint. Accordingly, the inventors disclosed two types of automatic magnetic switches in the US Pat. No.4,739,291 and No. 5,777,536. The structures of these switches are simper than the conventional switches but still too complicated for manufacture. They are thus desirable to be further improved on the structures thereof.

SUMMARY OF THE INVENTION

It is therefore a primary object of the invention to provide a hermetically sealed electrical switch assembly, which is capable of waterproof, corrosion-proof, dustproof and explosion-proof to provide a more sensitive and safer operating.

Another object of the invention is to provide a simple hermetically sealed electrical switch assembly, which has a lower manufacture cost.

According to the present invention, the hermetically sealed electrical switch assembly comprises a casing having an opening end, a cover sealingly attached to said opening end of said casing to define a primary volume hermetically sealed from external environment, switch means received in said primary volume, magnetic responsive means arranged inside said primary volume, and magnetic activating means attached to the upper surface of said cover for effecting the movement of said magnetic responsive means. The switch means comprises electrical contacts to change the conducting state of a power circuit with which said switch means is connected. and a switching lever which can change its

positions according to the conducting state of the power circuit. The magnetic responsive means couples with said switching lever for moving with it.

When the circuit said electrical switch assembly connected is in an over-loaded or short-circuit state, said switching lever of said switch means will switch automatically from a first (ON) position to a second (OFF) position. In the meantime, said magnetic responsive means will be forced by said switching lever to slide to the same way and said magnetic activating means will be forced to slide synchronously by the magnetic attractive force therebetween.

When said switch assembly is desired to be reset after the circuit is opened, User can push said magnetic activating means manually to force sliding to original position. In the meantime, said magnetic responsive means will slide synchronously to the same way by the magnetic attractive force and said switching lever will be forced to switch to the ON position.

BRIEF DESCRIPTION OF THE DRAWINGS

Other features and advantages of this invention will become apparent in the following detailed description of the preferred embodiments of the invention with reference to the accompanying drawings, in which

FIG. 1 is a perspective exploded view of a preferred embodiment of a hermetically sealed electrical switch assembly according the present invention;

FIG. 2 is a perspective view of the preferred embodiment;

FIG. 3 is a perspective view of the preferred embodiment with a partly sectional view taken along the line 3-3 as shown in FIG. 2;

FIG. 4 is a schematic view of said magnetic responsive and activating means of the preferred embodiment;

FIG. 5 is a perspective exploded view of a second preferred embodiment of a hermetically sealed electrical switch assembly according the present invention; and

FIG. 6 is a perspective view of the second preferred embodiment.

DETAIL DESCRIPTION OF THE INVENTION

Referring to FIG.1 to FIG.4, a preferred embodiment **100** of a hermetically sealed electrical switch assembly comprises a casing **110** having an opening end at its upside, a cover **112** sealingly attached to said opening end so as to define a hermetically sealed primary volume **114**. A conventional electrical switch means **120,** for example a conventional circuit breaker**,** having a switching lever **122** receives fixedly in the primary volume **114**. The switching lever **122** can switch between an ON position and an OFF position according to the conducting states of the contacts of the switch means **120**. In the embodiment, the switch means **120** is arranged such that the switching direction of the switching lever **122** is along the elongated direction of the casing **110**.

The casing **110** also has two side volumes **115** at the two opposite sides of the primary volume **114** respectively. Each of the two side

volume **115** is sealingly covered by a side cover **116** respectively. A conducting board (not shown) receives in the side volume **115**. A plurality of connectors **117** are mounted on each lengthwise wall of the casing **110** and connected with the conducting board for connecting the external circuit. The switch means **120** respectively has a plurality of terminals **124** at two opposite sides thereof which are connected to the conducting board.

A plate retainer **130**, which is made of non-magnetic material, such as stainless steel, aluminum alloy or plastic steel, mounts on the under surface of the cover **112**. The retainer **130** has a depressed room **131** at the upside thereof for defining a first chamber when it is mounted on the cover **112**. The center portion of the depressed room **131** has an elongated guiding opening **132**. The switching lever **122** extends to the depressed room **131** via the guiding opening **132.**

A magnetic responsive means **140** is fitted in the first chamber. The magnetic responsive means **140** has an inner body **141**, which is constituted by two parallel seat members **142** and two ribs **143** having two ends fixing at each of the seat members **142** respectively. Each of the seat members **142** pivots with two rollers **144** and mounts with four first magnet devices **145.** The first magnet devices **145** is a rectangle magnet in the embodiment. Referring to FIG. 4, between each of the two first magnet devices **145** disposes with a block **146** respectively. The blocks **146** are made of nonparamagnetic material. Each of the seat members **142** further has two paramagnetic strips **147** disposed at the bottom sides of the seat members **142** with each of which attaching across two of the first guiding devices **145** respectively. Thus, eight first magnet devices **145**

and four paramagnetic strips **147** will constitute four independent U-shaped magnets. Certainly, the above-described structure can be directly constituted by two U-shaped magnets mounted at each seat member **142**.

The ribs **143** of the inner body **141** forming a space therebetween. The switching lever **122** is wedged in the space for moving with the magnetic responsive means **140** together.

A capping **150** attaches to the upper side of the cover **112** for defining a second chamber. The capping **150** has an elongated opening **151** corresponding to the guiding opening **132**. The capping **150** is respectively marked "ON" and "OFF" near the opposite ends of the opening **151** corresponding to the ON position and the OFF position of the switching lever **122** of the switch means **120**.

A magnetic activating means **160**, referring to FIG. 4, has an outer body **161**. The outer body **161** pivots with a roller **162** at four corners thereof. Each of the outer body **161** mounts with four second magnet devices **163** respectively. Just like the magnetic responsive means **140**, the second magnet device **163** is also a rectangle magnet in the preferred embodiment. Between each of the two second magnet devices **163** mounts with a block **164** respectively. Four paramagnetic strips **165** dispose at the topside of the outer body **161** being stuck on two of the second magnet devices **163** respectively to form four independent U-shaped magnets with N poles and S poles orientated downward corresponding to the first magnet devices **145** of the magnetic responsive means **140**.

The poles of the first magnet devices **145** are opposite to the poles of

the corresponding second magnet devices **163** for providing a magnetic attractive force. Thus the magnetic responsive means **140** and the magnetic activating means **160** isolated by the cover **112** can slide synchronously.

The magnet activating means **160** receives in the second chamber with a switching handle **166** at the topside of the outer body **161** extending through the opening **151** of the outer cover **150** and the rollers **162** engage with the cover **112.** Whereby, the magnet activating means **160** can slide along the opening **151**.

In the embodiment, there are two parallel elongated paramagnetic portions **118** disposed in the central portion of the cover **112**. The first and second magnet devices **145, 163** are corresponding to the paramagnetic portions **118** of the cover **112** respectively for enhancing the magnetic attractive force therebetween.

The utilization and the principles of the invention are described hereinbelow.

When the circuit is in an over-loaded or short-circuit state, the switching device **122** of the switch means **120** will switch automatically from the ON position to the OFF position. In the meantime, the magnetic responsive means **140** will be forced to slide to the same way and the magnet activating means **160** will be forced to slide synchronously to the "OFF" position by the magnetic attractive force therebetween. In other words, the outer switching handle **166** of the magnet activating means **160** will be switched corresponding to the switching device **122** of the switch means **120** anytime.

When the switch means **120** is desired to be reset after the circuit is

opened, User can push the outer switching handle **166** to force the magnet activating means **160** sliding to the ON position. The magnetic responsive means **140** will slide synchronously to the same way by the magnetic attractive force. In the meantime, the switching lever **122** of the switch means **120** will be forced to switch to the ON position. For the same operating principle, when user pushes the switching handle **166** from the "ON" position to the "OFF" position, the switching lever **122** of the switch means **120** will be forced to switch to the "OFF" position.

Now referring to FIG.5 and FIG.6, a second preferred embodiment **200** of a hermetically sealed electrical switch assembly, which has a structure similar to the structure of the first preferred embodiment **100**, comprises a case **210**, an electrical switch means **220**, a magnetic responsive means **230**, a cover **240** and a magnetic activating means **250**.

Hereunder we should describe the structure of the second preferred embodiment **200** different from the first prefer embodiment **100**.

The case **210** has a opening end **212** at the top side thereof. The cover **240** attaches to the opening end to define a primary volume **214** hermetically sealed for receiving the electrical switch means **220**. The cover **240** disposes at the upside thereof with a sector-shaped guiding room **241** and an arc receiving slot **242** next to the wide end of the guiding room **241**. The receiving slot **242** has a deeper depth than the guiding room **241**. An outer shaft **243** has one end disposing at the upside of the cover **240** locating at the curvature center of the guiding room **241**. An inner shaft **244** has one end disposing at the underside of the main cover **240** corresponding to the outer shaft **243**.

The magnetic responsive means **230** has a sector-shaped inner body

231 and a concave room 232 at the wide end thereof. A plurality of first magnetic devices 233 are received in the concave room 232. The first magnetic devices 233 are U-shaped magnets having N poles and S poles orientating upwards. The inner body 231 further has a guiding hole 234 at midsection thereof and a pivoting hole 235 at the curvature center thereof.

The magnetic responsive means 230 receives in the primary volume 214 of the case 210 with the inner shaft 244 of the cover 240 receiving in the pivoting hole 235 for free rotating. The switch means 220 has a switching lever 222 receiving in the guiding hole 234 of the inner body 231 for driving the switching lever 222 to move with the inner body 231. The first magnetic devices 233 are corresponding to the bottom wall of the receiving slot 242 of the cover 240.

A cover plate 260 mounts at the upside of the cover 240 covering the guiding room 241 and the receiving slot 242. The cover plate 260 has a pivoting hole 262 for the outer shaft 243 of the cover 240 extending through. The cover plate 260 marks with "ON" and "OFF" at the upside thereof corresponding to the ON position and the OFF position of the switch lever 222 of the switch means 220.

The magnetic activating means 250 has a sector-shaped outer body 251. The outer body 251 has a pivoting tube 252 at the curvature center thereof and a skirting edge 253 at wide side thereof. The skirting edge 253 has a concave room 254 for receiving a plurality of second magnetic devices 255 having N poles and S poles orientating downwards. The outer body 251 is received in the guiding room 241 with the outer shaft 243 of the cover 240 received in the pivoting tube 252 with the skirting edge 253 received in the receiving slot 242 of the cover 240 for free

rotating. The pivoting tube **252** of the outer body **250** passes through the cover plate **260** via the pivoting hole **262**. An outer switching handle **264** fixed at the pivoting tube **252** with one end thereof for driving the outer body **251** to turn from outside.